ENGINEERING CASE LIBRARY

ECL 248

TO PINCH OR NOT TO PINCH

An inspector on an assembly line loses some fingers when the line moves. Was he a victim of negligence by the manufacturer, or was he at fault? This case, through background history, technical information, and questions relating to the incident allow the student to make the decision.

Names, but not events, have been disguised.

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TO PINCH OR NOT TO PINCH (A)

Circumstances

On 24 May 1974, Mr. Dennis Olson was at work at a station on an assembly-transfer line. His task was to inspect differentials, accept or reject them, then push a button to move the line. According to his story, he was just about to complete his inspection by marking the housing when the line moved without his having pushed the operating button, catching his right hand and resulting in the loss of three fingers.

Background

The assembly machine was built by CROWN Manufacturing Company to functional specifications on an order by PDQ Corporation. CROWN designed, built, and installed the machine in the spring and summer of 1968 at a cost of about $1,000,000.

The general layout at Mr. Olson's work station is shown in Exhibit A1. The transfer line is shown with differentials in position. The specific work station involved two differentials, at positions A and B in the center of the exhibit. An emergency stop line (carrying "RQ" poster) is directly overhead. A pull on this line will shut off the transfer operation. A second way of stopping movement of the line is a push button on the lower box at the extreme left of Exhibit A1.

A better view of the immediate work station is shown in Exhibit A2. Station A is shown empty but there is a differential at station B. The control switch box for this work station is shown at the worker's right. It might be noted that the "mushroom" button at the left is the one pushed to move the transfer line. The right hand "button" is recessed and requires a key to operate. It is not an emergency stop button.

At the time of his injury, Mr. Olson had the task of inspecting differentials at Stations A and B for dimensional accuracy and proper engagement of the gears. When he had completed his inspection task and marked the differential, he pushed the control button at his station.

It should be noted that there were several work stations along the transfer line, with a specific task performed at each station. As each worker completed his assigned operation, he pushed his switch button to clear his station. The last button to signal clearance activated the whole line which moved the differentials forward (to the right) to the next station. There was no way of telling which work station would be the last to clear, in fact, the last to clear might be any one of the stations on the line. Thus each individual worker could not tell when he pushed his button whether the line would move immediately or whether he would have to wait some appreciable time before the line moved and he could perform his task on the next differential on the line.

During the time tasks are being performed on the differentials, the differential rests on two posts, or supports, "front" and "back" as viewed by the worker. The differential resting on the posts is shown in

Exhibit A2. The "back" post is seen in Exhibit A3. When the transfer line moves, a recessed block (X, Exhibit A3) mounted on the transfer bar (Y, Exhibit A3) moves vertically upward with the transfer bar and lifts the differential high enough to clear the top of the post. The transfer bar, carrying differentials from each station on the line, moves to the right. At the end of its travel it lowers the differential onto a new pair of posts, and returns to the left to its initial position. Exhibit A4 shows a differential nested in the recessed block while being transferred to the right.

Mr. Olson had completed his inspection of the differential at Station A and was in the process of marking the differential at Station B (the last step in his task) when (according to his story) the line moved. He was leaning over the differential to place the mark on the left side (from his position) of the housing and thus his hand had to be "under" the differential. He had not pushed his activating button. He tried to withdraw his hand when he felt the movement of the line but was not quick enough, so that his right hand was caught and he lost three fingers.

At the time, Mr. Olson was about 40 years old. He was a responsible worker. He had been involved with this assembly-transfer line since it was installed, first as a line worker and then as a foreman. At the time of the injury, there had been some layoff of workers, but Mr. Olson had enough seniority to retain a job although he had to return to a line job from the foreman level.

Mr. Olson later retained an attorney, Ms. Keen. She, in turn, retained an experienced mechanical/metallurgical engineer, Mr. McGowan, to investigate to determine if there were a basis for products liability litigation.

Mr. McGowan and Ms. Keen visited the plant and examined the assembly-transfer machine on 11 March 1975. Mr. McGowan later wrote a report which said in part:

> "It is obvious from seeing the transfer line in operation that the front end of the recessed block must move to the right of the left side of the post at the new station. Thus, in effect, when the moving transfer bar approaches the fixed post at the station, a shear (somewhat similar to a pair of scissors) is created. Any object caught in this pinch point will be damaged.
>
> "It is my opinion that this section of the transfer line, as delivered and installed, was inherently defective by failing to provide adequate safety protection for the operator. This defect could be easily eliminated at a rather minor cost."

At a later date, Ms. Keen filed suit against CROWN on behalf of Mr. Olson, seeking $100,000 in compensatory damages.

Depositions

As part of the process of preparation for a trial, attorneys have the right to depose witnesses for the purpose of determining what is known. This is of benefit to all parties since potential issues can be explored. Those issues on which there is disagreement are put into focus and identified for trial purposes.

On 11 May 1978, Mr. Potter, representing CROWN, deposed Mr. McGowan. After determing Mr. McGowan's credentials and qualifications, much of the questioning focussed on the transfer operation and the possible existence of a pinch point. A photograph was used as a deposition exhibit and is shown here as Exhibit A5. The substance of Mr. McGowan's testimony was that motion of the transfer bar would create two pinch points. During forward motion (i.e., to the right) of the bar in the upper position, the recessed block passes the post with a clearance of about 1/16 inch between them. Since the top of the bar (bottom of the recessed block) is below the top of the post, the front side of the block will create a shear or pinch point when it passes the left side of the post (sides marked with an "x" in Exhibit A5). This pinch will be at the middle and right posts. During return motion, with the transfer bar in the lower position, a similar pinch point is created. (Sides marked with an "o" in Exhibit A5). This latter pinch point will not be at the post at the right end of the transfer bar travel but at the two posts to the left, i.e., the middle and left posts. Mr. McGowan further testified that this pinch point at the right post could have caused the injury to Mr. Olson.

Mr. McGowan admitted that he had no photographs to show (Some SX-70 pictures were taken but without flash bulbs so they were not useful), that he had taken neither physical dimension nor time measurements. But he maintained that there were two pinch points as indicated above.

Mr. Potter and Mr. Sharp (a senior member of the same firm as Mr. Potter), acting on behalf of CROWN engaged the services of Mr. Dupree, a registered professional mechanical engineer with many years of experience. Mr. Dupree was deposed by Ms. Keen on 19 September 1978.

Mr. Dupree testified that, in addition to seeing a number of photographs of the machine, he had seen the actual machine on 6 June 1978. He testified that he observed Mr. Olson's work station for about half an hour at that time although he took no photographs nor any physical measurements. He did time the transfer cycle of the machine with his wrist watch but not with a stop watch.

Mr. Dupree testified that there was no pinch point on the advance stroke but there was on the return stroke. In other words, it was his opinion that movement of the transfer bar in the upper position did not create a pinch point but return movement in the lower position did.

Ms. Keen asked: "Does the operator have any warning that the machine is about to cycle to the right, if he has not depressed his button?" Mr. Dupree answered: "I have no idea that it will. I have no idea, I could not answer that question."

Mr. Dupree further testified that the total time for the transfer to occur was about 8 seconds, i.e., to raise, move to the right, lower, and move to the left to the starting position. He said: "So, the man has all the knowledge and forewarning that the machine is in a cycle mode, regardless, whether he pushes a button -- two buttons, or ten buttons. He knows it is in a cycle mode when it moves up and holds there, a definite hold." He testified it took about 2 seconds for the bar to raise, and about 2 seconds for it to move about thirty, thirty-three inches (an estimate, not measured) to the right. He could not say how far the bar moved vertically.

Mr. Dupree testified that he believed Mr. Olson was injured sometime during the leftward (return) movement of the transfer bar. He did admit that there was nothing on the machine to physically prevent the operator from putting his hand into the machinery whether the bar was moving to the right or to the left.

Obviously, there is a difference of opinion between the two independent well-qualified experts retained by plaintiff and defendant, two experts who admit that they have not taken any measurements of dimensions or time although Mr. Dupree did make a rough time measurement. In your opinion, which, if either, is correct about the pinch point? If you believe there is a pinch point, especially on the forward stroke, how would you eliminate it? What is your reaction about Mr. Dupree's statement relative to warning for the worker if he had not pushed his button but the machine did indeed cycle? Is it possible for a machine to cycle without all activating buttons having been pushed? How could Mr. Olson have been injured? How do you feel about the activating system for the transfer line, i.e., does it provide adequate safety protection? If not, how would you modify it? Are you satisfied with the information which you have? If you need more, what do you need and how would you go about getting it?

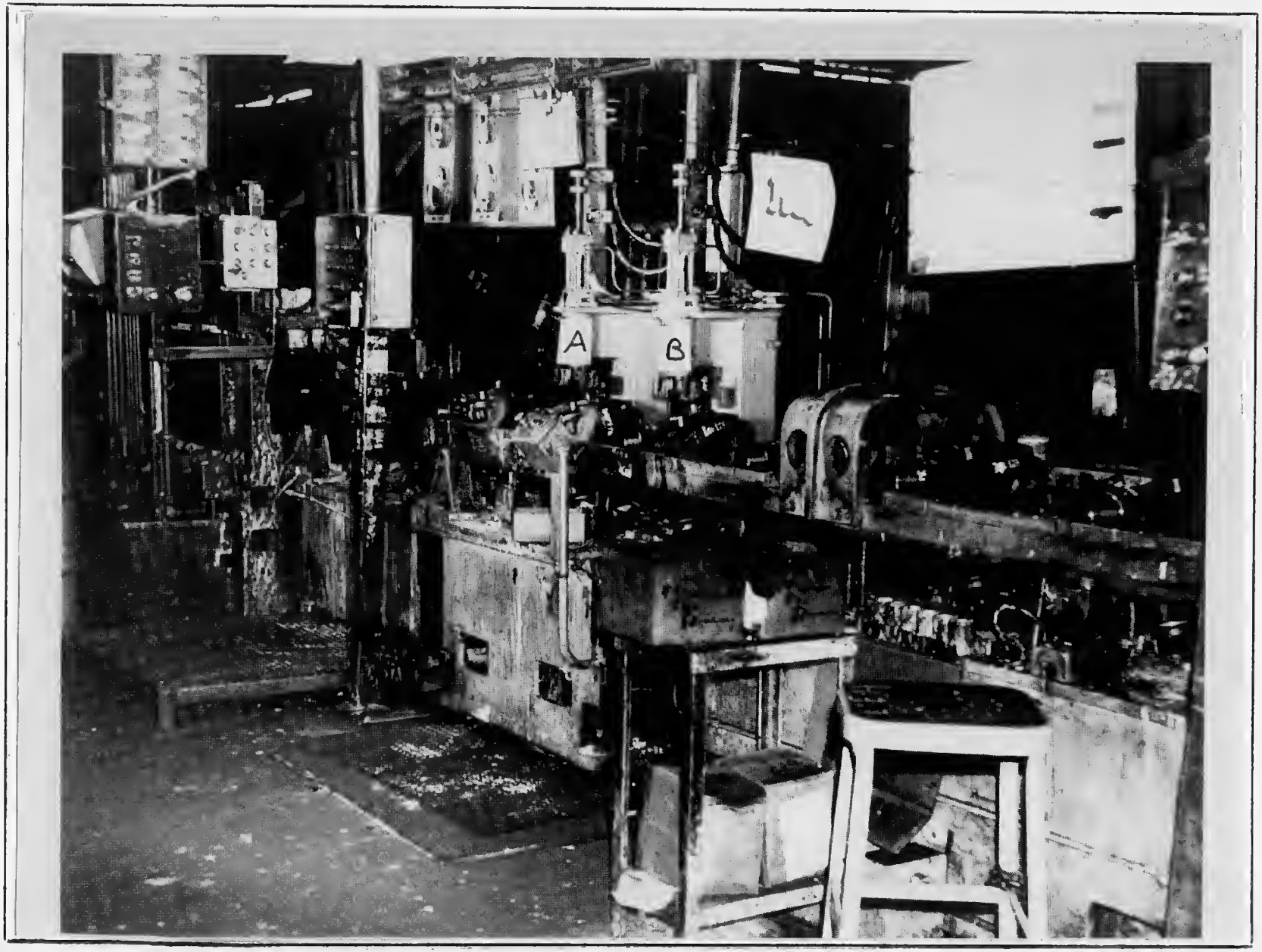


Exhibit A1 -- General appearance of the work station where the injury occurred. The worker stood on the mat in the lower center of the picture. The two differentials on which he worked were at the locations labeled A and B. Differentials are shown in position on the transfer line. Overhead emergency stop cord is shown.



Exhibit A2 -- Close view of work station where injury occurred. A differential undergoing inspection, is shown in position at location B. The worker is expected to place his inspection certification on the differential housing in the approximate location indicated by the right hand of the individual shown at the work station. The switch box for this station is obvious in the foreground. The switch button is the "mushroom" type on the left side of the box.



Exhibit A3 -- "Back" side of transfer line showing a differential housing resting on a support or post which holds the housing while work is being done on it. When the line is to move and carry the differential to the next station, the transfer bar (Y) moves upward vertically so that the attached recessed block (X) picks up the end of the housing, raises it above the top of the post, and carries the housing to the right to the next station.



Exhibit A4 -- View of the differential housing nested in the recessed block while being transferred to the right. The scale indicates the overall height of the block above the top of the transfer bar.

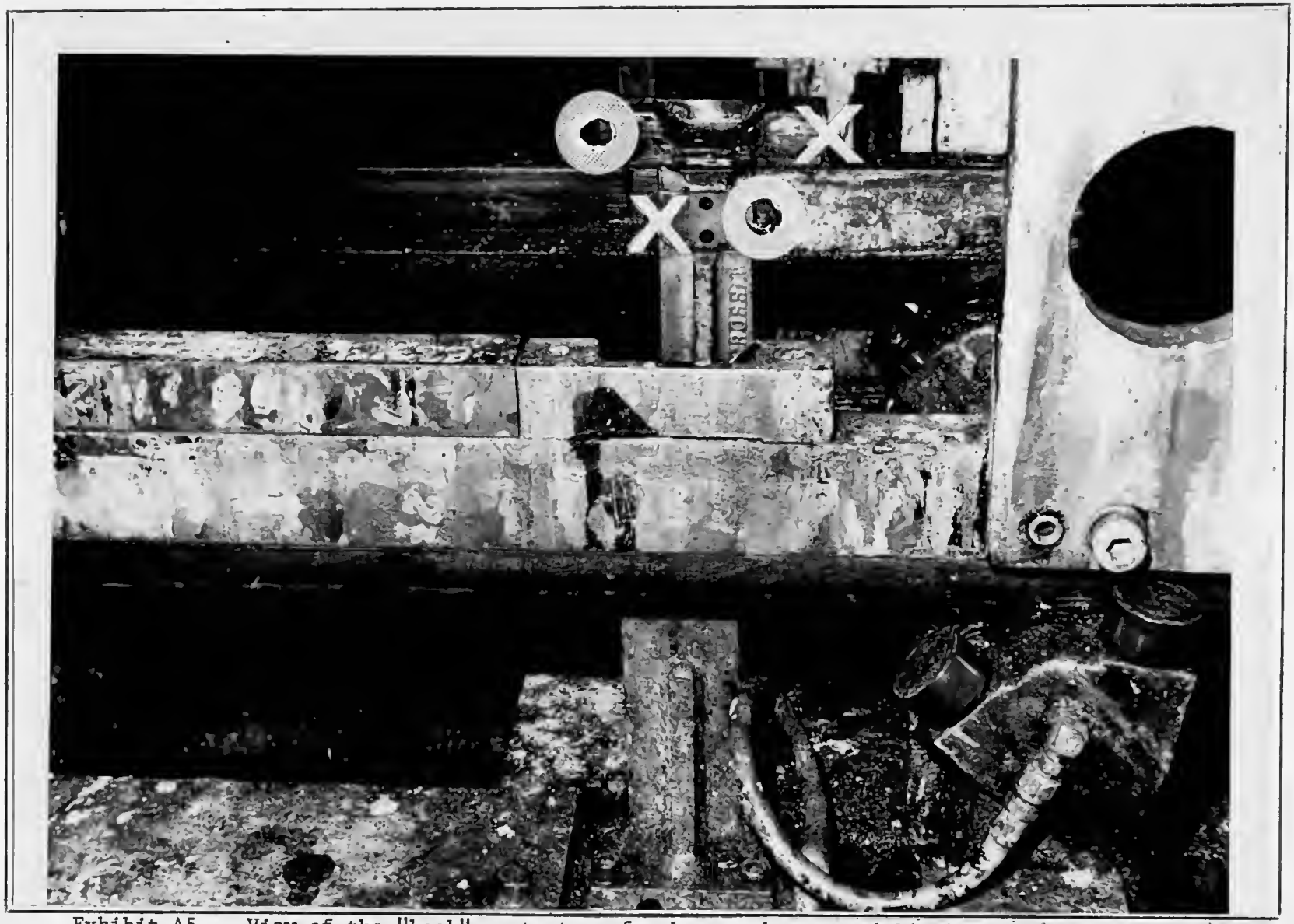


Exhibit A5 -- View of the "back" post, transfer bar, and recessed block. This was used as an exhibit during deposition of Mr. McGowan, the expert retained by plaintiff's attorney. Mr. McGowan contended that, as the transfer bar in its upper position moved to the right, a pinch point was created when the right end of the recessed block (X) reached the left side of the post (X). A similar pinch point (coincidence of 0's) is created on the return of the transfer bar to the left.

TO PINCH OR NOT TO PINCH (B)

Ms. Keen Takes Another Look

After taking Mr. Dupree's deposition, Ms. Keen still believed Mr. McGowan was right (she had retained his services on previous occasions) but to be certain, she visited the PDQ Corporation plant and looked at the machine again. There was no question in her mind and she was ready for trial. She believed that CROWN should settle out of court but CROWN showed no inclination to do so.

Mr. McGowan Digs Deeper

Trial started with jury selection on 17 October 1978. The same day, Mr. McGowan went back to the PDQ Corporation plant for another look at the machine and to make some measurements. A professional photographer accompanied him and took some pictures.

Using a stopwatch, Mr. McGowan determined that the transfer bar took two seconds to move vertically to the upper position, hesitated briefly, and then moved to the right in 2 seconds, hesitated briefly, moved vertically to the lower position in two seconds, hesitated briefly, and then returned to the left in two seconds. The total cycle time was eight seconds. The hesitation at each change of direction was noticeable but too short to time. He also determined that it took 2.5 seconds for the transfer bar to raise vertically and move to the right to create the "forward" pinch point.

According to Mr. McGowan's measurements, the recessed block was 1½ inch x 1½ inch x 6 inches long. It was bolted to the top of the transfer bar (as indicated in Exhibit A4). The differential went about ½ inch into the recess. The centerline distance between posts was 2 feet. Since the transfer was for two posts, the bar moves 4 feet to the right on the forward stroke and 4 feet to the left on return.

Mr. McGowan measured the vertical travel as 1-3/4 inch. He also measured the top of the post as being 1¼ inch above the top of the recessed block when the transfer bar was in the lower position.

Mr. McGowan Testifies

Meanwhile, back in the courtroom, jury selection was completed, and trial started with direct examination of Mr. Olson who told his story of how he was injured. This included testimony that he had personal knowledge of malfunction of the transfer, i.e., the machine would sometimes transfer without all buttons being pushed. On the morning of 18 October 1978, Mr. Sharp cross-examined Mr. Olson, seeking to "shake" his story and find discrepancies, but with no success.

Mr. McGowan went on the witness stand before the morning was over and stayed on the stand until the middle of the afternoon of 20 October 1978, i.e., between 1½ and 2 days of testimony under both direct and cross-examination.

He testified relative to his measurements and his opinion that a pinch point was created between the recessed block and the post during forward motion of the transfer bar. Ms. Keen sought to introduce one of the photographs taken on 17 October 1978 into evidence. (Exhibit B1) Mr. Sharp objected on the basis that this was without foundation, i.e., that Mr. McGowan had no way of knowing for certain that the machine as he saw it on 17 October 1978 was indeed the same as it had been on 24 May 1974 when Mr. Olson was injured. This was, of course, a valid objection. At this point, Ms. Keen got permission to recall Mr. Olson to the stand. Mr. Olson testified that he had been very familiar with the machine from the time of installation until that day and there had been no modification. The judge then received the photograph in evidence. This indicates that the top of the post was about ½ inch above the top of the transfer bar in its upper position while differentials are being moved. The pinch point thus created is shown in Exhibit B2. (This testimony, of course, was consistent with Mr. McGowan's earlier deposition testimony.) Mr. McGowan returned to the witness stand.

Ms. Keen also introduced as evidence a CROWN drawing (a portion is shown in Exhibit B3). Under direct examination, Mr. McGowan showed that this drawing indicated about 1 inch upward travel for the recessed block to contact the differential housing with 0.80 inch further upward travel to clear the post. He testified that his measurement was consistent with the drawing.

Mr. Sharp then produced another drawing (a portion is shown in Exhibit B4). He asked Mr. McGowan if the transfer bar lift were shown on it. When the reply was affirmative, Mr. Sharp wanted to know why there was a discrepancy between Mr. McGowan's measurement and the drawing. Mr. McGowan replied that there did indeed appear to be a discrepancy and that he had no specific explanation. He could only surmise that perhaps the machine was made as he had measured, despite the drawing, and that the drawing wasn't changed to reflect the actual situation. When questioned about this, Mr. McGowan simply said that sort of thing does happen fairly often.

In response to Ms. Keen's questions, Mr. McGowan had testified that it was his opinion that there was indeed a pinch point on the forward stroke. When asked if this could be eliminated, he said that it could. He testified that one way would be to raise the transfer bar higher by about 3/4 inch so it would be above the top of the post on the forward stroke. A second way would be to fill in the space on the top of the transfer bar between each pair of recessed blocks. This would have the effect of raising the top of the transfer bar to the same level as the top of the recessed block. Thus both would be above the top of the

support post when the transfer bar moved in the upper position. It was his opinion that this would effectively eliminate the pinch point. This solution would also be relatively inexpensive. He further testified that this was possible within the "state of the art" at the time the machine was designed and built in 1968.

In his deposition, Mr. Dupree had indicated a "definite hold" of the transfer bar between its upward vertical movement and its movement to the right. Thus, in effect, he believed the worker had ample warning of the cycle, independent of pushing any buttons.

In seeking to rebut this (in advance, since the jury did not have access to the depositions), Ms. Keen asked Mr. McGowan about such warning. Mr. McGowan testified that the worker would have his attention on his work, especially if he were bent over to mark the underside of the differential housing. The transfer bar would move upward vertically about one inch (requiring about one second) before it started to move the differential. In other words, the worker would have no warning until the transfer bar touched him or he felt the differential start to move. From the moment the differential started to move upward, there would be about one and one-half seconds until the pinch point was created. In addition, there was no certainty that a worker would be conscious of initiation of movement of the differential, i.e., it might have to move some before the worker were conscious of this and reacted. In any event, in his opinion, it was not proper to rely on such an indefinite warning when the pinch point could be positively eliminated.

Ms. Keen asked Mr. McGowan if he had an opinion relative to safety provided workers by the system for activating transfer to parts. He said he believed it lacked safety protection. Once a worker pressed his button to signal that his station was clear, he had no way of knowing if the transfer would occur immediately or if there would be a delay because some other station was not yet clear. No provision was made to prevent the worker from putting his hands back into his work station once he had signalled clearance. Mr. McGowan said that a requirement for each worker to keep his hands on two buttons (not one) until the differentials were transferred should be effective in providing protection. He did state, however, both in direct testimony and in response to cross-examination, that he believed workers would have a strong dislike for such a requirement. No question was raised about any alternative.

When Mr. McGowan was excused from the witness stand, Ms. Keen called Mr. Black who had been foreman on the line on the day that Mr. Olson was injured. He testified that he knew Mr. Olson well, that Mr. Olson was a good and responsible worker, and that they did not associate outside of working hours. He testified that the machine had been operated since installation without modification although the posts were replaced when worn and routine maintenance practices had been followed. He further testified that he had known the machine to cycle (and transfer differentials) a number of times before all the workers

on the line had pushed their buttons to move the line.

At the end of the fourth day of trial, a Friday, Ms. Keen had completed presenting the evidence for her case on behalf of Mr. Olson and cross-examination had been completed.

How do you see the situation now? What should the manufacturer do? Should he settle out of court? Should he continue and have Mr. Sharp present the defense? What action, if any, should be taken over the weekend by either party? If the testimony of Mr. Olson, Black and McGowan is true, what kind of a defense can Mr. Sharp present for CROWN? What can Mr. Dupree say in light of his deposition and Exhibit B1?



Exhibit B1 -- Photograph taken under Mr. McGowan's direction on 17 October 1978. In this view, the transfer bar is in the upper position and moving the differential to the right. The clearance between the transfer bar and the post is seen as a dark line (shadow). The scale is resting on the top of the transfer bar with one edge of the scale against the back of the post.



Exhibit B2 -- View of the pinch point which was created (in Mr. McGowan's opinion) when the right end of the recessed block approached the left side of the post when the transfer bar was moving to the right in the upper position.

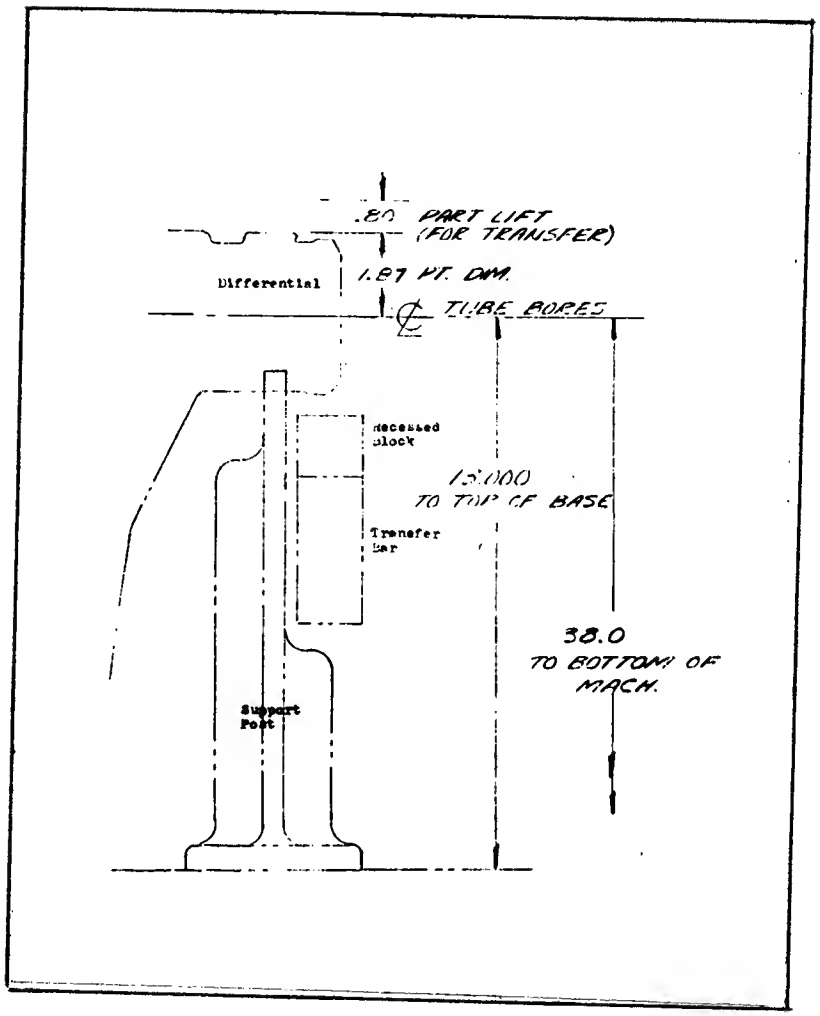


Exhibit B3 -- Portion of assembly drawing (supplied by CROWN) showing the differential, support post, and transfer bar with the recessed block.

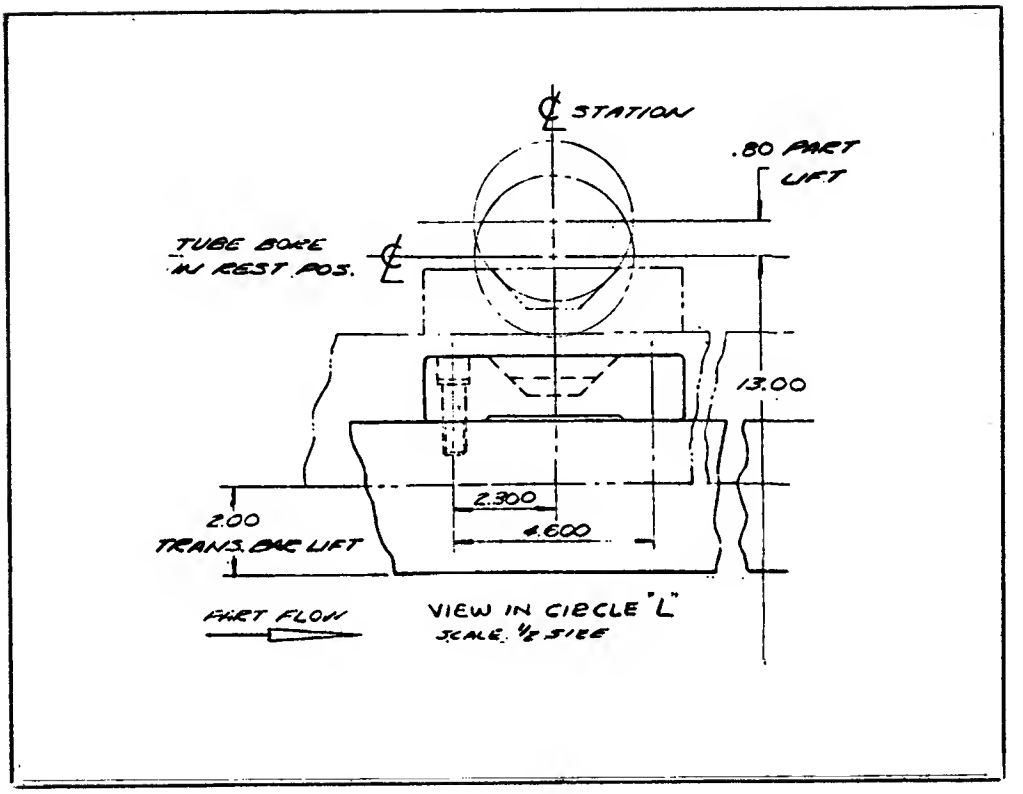


Exhibit B4 -- Portion of a second assembly drawing (supplied by CROWN) showing an end view of the differential and a side view of the transfer bar and recessed block.

TO PINCH OR NOT TO PINCH (C)

Resumption of Trial

Trial resumed on Monday, 23 October 1978, with Mr. Sharp calling Mr. Dupree to the witness stand. After about 40 minutes of testimony, Mr. Sharp requested a brief recess which the judge granted. At that point, an offer was made to Ms. Keen by CROWN to settle for the $100,000 originally sought as compensatory damages. At that point, Ms. Keen didn't want to settle, but the decision was up to her client, Mr. Olson. It was his judgment that they should settle, take the money and be done with the suit. Once agreement was reached, Ms. Keen made a relatively uncommon request of the judge, i.e., for permission to talk with the jury. (As she explained it later, she believed she had convinced the jury and felt they might have returned a verdict for Mr. Olson greater than $100,000.) The request was granted. The result of the discussion was that (as she said) her ego was satisfied that she had indeed convinced the jury at that stage of the trial. The question of how much they might have awarded hadn't entered their minds.

Comments

An offer of settlement for the full amount of the damages sought is rather rare. One can only conclude that CROWN became convinced that a solid case had been made for the plaintiff, a case whose credibility would be most difficult to shake, and that the jury might well come back with a verdict for the plaintiff for a greater amount. After all, it seemed clear that Mr. Olson was a responsible citizen and he had been an excellent witness on his own behalf. There was no question that he was physically handicapped for the rest of his life with a significant reduction in earning potential.

One interesting aspect of settlement is that Ms. Keen had another client who had been injured in a somewhat similar fashion on a different section of the same machine and thus CROWN had been the defendant in that case also. That one was settled out of court only a few months earlier but CROWN would not discuss settlement in the Olson case. Ms. Keen believed the Olson case had stronger evidence and that Mr. Olson would be a good witness (which he was), and a much better witness than her other client.

When Mr. Olson was injured, PDQ Corporation modified the machine to eliminate the pinch point. It is not clear that this was accomplished before the next shift but it is definite that it was accomplished within 24 hours of Mr. Olson's injury. PDQ inserted sections of steel, 1½ inch deep by 1½ inch wide x 18 inch long in the gaps between the recessed blocks on the front transfer bar. These inserted bars were attached to the transfer bar by three countersunk cap screws per inserted bar. No bars were put on the rear transfer bar as no worker would be on that side of the machine. (Note that most of the exhibits actually

show the rear side.)

One of the intriguing legal aspects of a case such as this one is the question of "fixes" made after an injury. In most jurisdictions, and specifically in this one, rules of evidence forbid testimony on what was done to improve a design or eliminate a defect. Thus, during this trial, no witness could make any references or allusion to the existence of the "fix" accomplished by PDQ although it was there in plain sight in several of the trial exhibits, as for example in Exhibits A1 and A2, and especially A5.